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EFFECT OF VARIOUS MULCHES ON GROWTH AND YIELD OF POMEGRANATE CV. BHAGWA

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ABSTRACT

The experiment was carried out at Department of Fruit science, Sector 70, University of Horticultural Sciences, Udyanagiri, Bagalkot, during the year 2015-2016 to evaluate the effect of organic and inorganic mulching materials on growth and yield of pomegranate cv. Bhagwa. Different mulching materials i.e., T_1-Black polythene mulch (100 microns), T_2-Silver polythene mulch (100 microns), T_3-White polythene mulch (100 microns), T_4-Paddy straw mulch (6" thickness), T_5-Sugarcane trash mulch (6" thickness), T_6-Maize stover mulch (6" thickness) and T_7-Control (without mulch). In mulching, the treatment T_1 i.e., plants under black polythene was found to be effective to improve the growth and yield of pomegranate cv. Bhagwa.

KEYWORDS: Pomegranate, Bhagwa, Mulches, Growth & Yield

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Original Article

INTRODUCTION

Pomegranate (*Punica granatum* L.) belongs to family Punicaceae, regarded as 'fruit of paradise', an ancient favourite fruit of tropical and sub-tropical regions of the world. The fruit is symbolic of 'plenty' and also referred as seed apple. Pomegranate, basically a crop of dry regions, where water is a scarce resource, needs to be brought under mulching, for realising higher yields of better quality. This will also lead to improvement in water use efficiency with optimum utilization of available water for maximising production. Therefore, such studies will be useful in accentuating production of quality fruits of pomegranate, with minimal use of water, thereby, increasing the water use efficiency of pomegranate plants.

MATERIAL AND METHODS

The field experiment was conducted at Department of Fruit science, Sector 70, University of Horticultural Sciences, Udyanagiri, Bagalkot. The experiment consists of seven treatments [T_1-Black polythene mulch (100 microns), T_2-Silver polythene mulch (100 microns), T_3-White polythene mulch (100 microns), T_4-Paddy straw mulch (6" thickness), T_5-Sugarcane trash mulch (6" thickness), T_6-Maize Stover mulch (6" thickness) and T_7-Control (without mulch)] laid out in randomized block design and replicated thrice.

Leaf area was recorded by using graph at monthly intervals. Newly developed shoot from the base was measured and expressed in cm. Chlorophyll content of leaves of each plant was measured with a portable meter (SPAD502®, Minolta, Japan) at monthly intervals. Leaves developed on the new shoot were also counted at monthly intervals. The numbers of fruits per plant was physically counted after maturity and were expressed as

numbers per tree.

Five randomly selected pomegranate fruits were weighed using digital analytical balance and the average value of fruit was expressed in grams**.** Fruit diameter in each treatment was measured with the help of digital vernier calipers at widest middle point where maximum girth was noticed and it was expressed in millimeters (mm). Fruit length in each treatment was measured with the help of vernier calipers and it was expressed in millimeters (mm). The fruit yield was recorded at the time of harvest and expressed in kilograms per plant. The fruit yield per hectare was computed by multiplying the yield per plant with the number of plants that can be accommodated in one hectare and was expressed in tonnes per hectare. Weight of hundred arils from each treatment was recorded and expressed in grams. Rind Thickness in each treatment was measured with the help of vernier calipers and it was expressed in millimeters (mm).

RESULTS AND DISCUSSIONS

Growth Parameters

Shoot Length (cm) and Number of Leaves/Shoot

The maximum shoot length of 63.44 cm, 71.81 cm, 77.13 cm, 83.26 cm and 88.41 cm at 30, 60, 90, 120 and 150 days after mulching, respectively (Table 1) and also number of leaves per shoot at 30, 60, 90, 120 and 150 days after mulching were 109.33, 115.67, 121.00, 136.00 and 145.00, respectively was recorded in plants mulched with black polythene (Table 2). Higher vegetative growth in black polythene may be due to adequate moisture in the soil, which is vital for plant growth and in turn helps to increased intensive metabolic processes, better nutrient uptake and translocation of nutrients. These results are in confirmation with Bakshi *et al*. (2014) who reported that black polythene mulched plants increased number of leaves due to more plant growth and development under micro-climatic condition in strawberry and Mahmoudand Sheren (2014) also reported that sub surface drip irrigation along with plastic sheet as mulching gave the higher shoot length and number of leaves per shoot in pomegranate.

Table 1: Length of Shoot at Different Stages of Plant Growth in Pomegranate CV. Bhagwa as Influenced by Different Types of Mulches

Treatments			Shoot Length (cm)				
			30 Days	60 Days	90 Days	120 Days	150 Days
T_1	-	Black polythene mulch (100 µ)	63.44 (16.49)	71.81 (25.80)	77.13 (28.33)	83.26 (27.85)	88.41 (23.32)
T_2	-	Silver polythene mulch (100 µ)	62.00 (14.55)	69.14 (22.94)	75.71 (26.98)	81.24 (26.05)	86.66 (21.77)
T_3	-	White polythene mulch (100 µ)	59.41 (10.82)	62.53 (14.79)	69.02 (19.91)	73.05 (17.77)	77.91 (12.99)
T_4	-	Paddy straw mulch (6" thickness)	60.13 (11.89)	65.51 (18.67)	72.13 (23.36)	78.93 (23.89)	83.78 (19.09)
T_5	-	Sugarcane trash mulch (6" thickness)	56.80 (6.72)	58.33 (8.66)	65.21 (15.23)	68.30 (12.05)	74.42 (8.91)
T_6	-	Maize stover mulch (6" thickness)	53.22 (0.45)	56.31 (5.38)	57.44 (3.76)	61.41 (2.18)	71.04 (4.57)
T_7	-	Control (Without mulch)	52.98	53.28	55.28	60.07	67.79
S Em ±			1.27	2.59	2.76	4.15	1.37
CD @ 5%			3.90	7.97	8.49	12.80	4.22

Values in parenthesis are per cent increase over control

Table 2: Number of Leaves per Shoot at Different Stages of Plant Growth in Pomegranate CV. BHAGWA as Influenced by Different Types of Mulches

Treatments			Number of Leaves/Shoot				
			30 Days	60 Days	90 Days	120 Days	150 Days
T_1	-	Black polythene mulch (100 µ)	109.33 (13.72)	115.67 (13.26)	121.00 (10.74)	136.00 (15.93)	145.00 (15.86)
T_2	-	Silver polythene mulch (100 µ)	107.33 (12.18)	114.33 (12.25)	119.33 (9.49)	128.00 (10.68)	136.33 (10.51)
T_3	-	White polythene mulch (100 µ)	104.00 (9.30)	111.00 (9.61)	118.05 (8.51)	125.67 (9.02)	130.00 (6.15)
T_4	-	Paddy straw mulch (6" thickness)	107.33 (12.11)	113.33 (11.47)	119.00 (9.24)	127.00 (9.98)	133.33 (8.50)
T_5	-	Sugarcane trash mulch (6" thickness)	104.33 (9.58)	112.00 (10.42)	115.33 (6.36)	123.00 (7.05)	129.67 (5.92)
T_6	-	Maize stover mulch (6" thickness)	104.33 (9.58)	105.67 (5.05)	110.33 (2.11)	116.00 (1.44)	127.00 (3.94)
T_7	-	Control (Without mulch)	94.33	100.33	108.00	114.33	122.00
S Em ±			2.06	2.32	2.25	3.18	3.09
CD @ 5%			6.36	7.13	6.93	9.79	9.54

Values in parenthesis are per cent increase over control

Leaf Area (cm^2)

The maximum leaf area of 8.08 cm^2, 10.93 cm^2, 11.39 cm^2, 13.63 cm^2 and 14.86 cm^2 was recorded in black polythene mulch at 30, 60, 90, 120 and 150 days after mulching, respectively (Table 3). It may be attributed to better soil hydrothermal regimes, better moisture conservation and suppression of weeds in plants mulched with black polyethylene. Thus, plants mulched with black polythene might have got better nutrient supply and resulted in maximum leaf area. Singh *et al.* (2006) also reported that black polythene mulch significantly increased the leaf area which aided by weed free environment and higher nutrient uptake. Higher leaf area (11.56 cm^2) under polythene mulch and organic fertilization in pomegranate was also recorded by El-Tawell and Farag (2015).

Table 3: Leaf Area at Different Stages of Plant Growth in Pomegranate CV. Bhagwa as Influenced by Different Types of Mulches

Treatments			Leaf Area (cm^2)				
			30 Days	60 Days	90 Days	120 Days	150 Days
T_1	-	Black polythene mulch (100 µ)	8.08 (15.97)	10.93 (20.86)	11.39 (15.28)	13.63 (20.84)	14.86 (20.12)
T_2	-	Silver polythene mulch (100 µ)	7.60 (10.66)	10.85 (20.28)	11.14 (13.38)	13.43 (19.66)	14.60 (18.70)
T_3	-	White polythene mulch (100 µ)	7.45 (8.86)	10.21 (15.28)	10.80 (10.65)	12.34 (12.56)	13.62 (12.85)
T_4	-	Paddy straw mulch (6" thickness)	7.50 (9.87)	10.78 (19.81)	10.99 (12.19)	13.10 (17.63)	14.27 (16.82)
T_5	-	Sugarcane trash mulch (6" thickness)	7.45 (8.86)	9.97 (13.24)	10.43 (7.48)	11.57 (6.74)	12.63 (6.02)
T_6	-	Maize stover mulch (6" thickness)	7.27 (6.60)	9.70 (10.82)	9.93 (2.82)	11.03 (2.17)	12.29 (3.42)
T_7	-	Control (Without mulch)	6.79	8.65	9.65	10.79	11.87
S Em ±			0.17	0.36	0.24	0.40	0.12
CD @ 5%			0.53	1.10	0.75	1.25	0.36

Values in parenthesis are per cent increase over control

Leaf Chlorophyll Content (SPAD Units)

The chlorophyll content of 60.58 SPAD units, 64.21 SPAD units, 72.85 SPAD units, 76.03 SPAD units and 83.89 SPAD units at 30, 60, 90, 120 and 150 days after mulching, respectively (Table 4). This may due to decreased thickness of leaf parenchyma tissues by solar radiation restriction as showed by high values contributed to the highest values of leaf chlorophyll on covered plants. This result was also confirmed by changes in leaf anatomy and increased chlorophyll content under protected cultivation to compensate the light restriction by plastic film as showed by Chavarria *et al.* (2012) in grapevine. Present investigation findings are in line with the results of Mahmoudand Sheren (2014) who reported that sub surface drip irrigation along with plastic sheet as mulch gave the higher percentage of leaf chlorophyll content in pomegranate.

Table 4: Chlorophyll Content at Different Stages of Plant Growth in Pomegranate CV. Bhagwa as Influenced by Different Types of Mulches

Treatments			Chlorophyll Content (SPAD Units)				
			30 Days	60 Days	90 Days	120 Days	150 Days
T_1	-	Black polythene mulch (100 microns)	60.58 (9.76)	64.21 (13.72)	72.85 (16.69)	76.03 (13.55)	83.89 (13.66)
T_2	-	Silver polythene mulch (100 microns)	59.71 (8.44)	63.12 (12.23)	66.59 (8.86)	73.90 (11.06)	81.36 (10.98)
T_3	-	White polythene mulch (100 microns)	56.88 (3.89)	60.69 (8.72)	63.78 (4.84)	72.60 (9.46)	80.06 (9.53)
T_4	-	Paddy straw mulch (6")	58.57 (6.65)	62.80 (11.78)	66.64 (8.93)	73.16 (10.16)	80.53 (10.06)
T_5	-	Sugarcane trash mulch (6")	55.66 (1.78)	59.93 (8.10)	62.93 (3.56)	70.83 (7.20)	77.13 (6.09)
T_6	-	Maize stover mulch (6")	55.48 (1.46)	58.34 (5.04)	61.95 (2.05)	70.50 (6.77)	78.31 (7.51)
T_7	-	Control (Without mulch)	54.67	55.40	60.69	65.73	72.43
S Em ±			0.93	1.34	1.52	1.09	1.42
CD @ 5%			2.85	4.13	4.68	3.37	4.39

Values in parenthesis are per cent increase over control

Yield Parameters

Higher fruit yield (20.87 kg/plant) and (26.08 t/ha) was recorded in plants mulched with black polythene. This was due to increase in number of fruits per plant (79.67), average fruit weight (299.42 g), fruit length and breadth (81.44 mm and 82.13 mm, respectively), total aril weight (193.78 g) and also better plant growth in plants mulched with black polythene. The increase in fruit yield may also be by conserving soil moisture, regulating temperature and suppressing weed growth. While, the unmulched plants (Control) recorded the minimum yield (11.47 kg/plant and 14.33 t/ha) because of less number of fruits per plant (50.11), less fruit weight (224.48 g), less fruit length and breadth (74.52 mm and 75.43 mm, respectively) and total aril weight (141.56 g). The results in the present investigation are in line with the results of Chattopadhyay and Patra (1993) who reported that mulching with black polythene in pomegranate recorded higher fruit yield (164 q/ha)(Table 5).

Table 5: Number of Fruits per Plant and Fruit Yield in Pomegranate CV. Bhagwa as Influenced by Different Types of Mulches

Treatments			Number of Fruits/Plant	Yield	
				(kg/Plant)	(t/ha)
T_1	-	Black polythene mulch (100 µ)	79.67 (37.10)	20.87 (45.04)	26.08 (45.05)
T_2	-	Silver polythene mulch (100 µ)	68.33 (26.66)	17.23 (33.43)	21.53 (33.44)
T_3	-	White polythene mulch (100 µ)	64.67 (22.51)	14.57 (21.28)	18.21 (21.31)
T_4	-	Paddy straw mulch (6" thickness)	66.33 (24.44)	16.46 (30.32)	20.57 (30.34)
T_5	-	Sugarcane trash mulch (6" thickness)	63.67 (21.30)	13.51 (15.10)	16.88 (15.11)
T_6	-	Maize stover mulch (6" thickness)	63.33 (20.87)	13.34 (14.02)	16.68 (14.09)
T_7	-	Control (Without mulch)	50.11	11.47	14.33
S Em ±			3.63	0.63	0.79
CD @ 5%			11.20	1.94	2.43

Values in parenthesis are per cent increase over control

Hundred aril weight (37.17 g), total aril weight per fruit (193.78 g) and rind thickness (4.18 mm) were maximum in plants mulched with black polythene (Table 6).

Table 6: Fruit Yield Attributing Characters in Pomegranate CV. Bhagwa as Influenced by Different Types of Mulches

Treatments			Fruit Weight (g)	Fruit Length (mm)	Fruit Width (mm)	100 Aril Weight (g)	Total Aril Weight of Fruit (g)	Rind Thickness (mm)
T_1	-	Black polythene mulch (100 µ)	299.42	81.44	82.13	37.17	193.78	4.18
T_2	-	Silver polythene mulch (100 µ)	290.83	79.53	81.41	36.20	182.03	4.12
T_3	-	White polythene mulch (100 µ)	269.00	77.17	79.25	33.07	177.92	3.36
T_4	-	Paddy straw mulch (6" thickness)	279.50	78.21	80.62	36.03	180.49	3.52
T_5	-	Sugarcane trash mulch (6" thickness)	262.42	76.39	78.22	32.93	173.51	3.42
T_6	-	Maize stover mulch (6" thickness)	253.75	76.49	76.72	32.47	156.91	3.32
T_7	-	Control (Without mulch)	224.48	74.52	75.43	32.87	141.56	2.94
S Em ±			10.68	0.87	0.85	0.37	5.14	0.18
CD @ 5%			32.93	2.69	2.62	1.15	15.83	0.55

CONCLUSIONS

In the present study, it could be inferred that mulching is better for plant growth and fruit production. Highest fruit yield was recorded in black polythene mulch followed by silver polythene mulch as compared to other mulches. Therefore, use of polythene mulch in pomegranate orchard has been found to be most effective because of its durability. It could be recommended that growers may adopt either black polythene mulch or silver polythene mulch for pomegranate orchard to obtain better yield with good economic returns.

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